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With the Author's compliments

THE DEVIL

DEMONSTRATED

BY

A PHYSIOLOGIST

PRINTED FOR THE AUTHOR

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PREFACE.

"THE DEVIL" was written some twelve years ago, and was submitted to friends in whose judgment I had confidence, the result being that it was returned to my desk for ten years. It then again saw the light, and has been submitted to the editors of two of the chief critical London reviews, who have advised its appearance, but only amongst a selected few, and that anonymously.

Now, although I have submitted to this dictum, I have done so much against the grain: I do not see the necessity of it. I am not ashamed of what I have written—it is the conscientious outcome of my studies: if true it cannot appear too soon, if false the sooner it is refuted the better, as there are numbers who hold the same opinions without being able to produce the evidence of their belief as I have done.

"The Devil" has been forwarded only to those who may be able to criticise it, of all shades of opinion, and is left to its fate by

THE AUTHOR.

June, 1878.

THE DEVIL.

Whilst engaged upon some important physiological investigations, the possible connection of the Principle of Evil with the viscera was forcibly impressed upon me. The following dialogue represents the position taken by myself, and one imbued with the ordinary views.

F. (A Friend of Doctor.)	*Dr.* (The Doctor.)
P. (A Patient.)	*S.* (The Doctor's Servant.)

F. Good morning. Well met! Where are you bound?

P. Westward.

F. I also; we will walk together. And how are you?

P. Not well. I am somewhat hipped—am in low spirits, and without any cause that I know of.

F. It is this east wind—enough to upset anyone.

P. I suppose so. What is the best thing to do?

F. Have you seen Dr. ——? He'll put you all to rights.

P. No. Let us go and see him now.

F. Here we are at the bottom of the street. I'll introduce you, if you like.

P. I should be much obliged to you.

F. Come along. Is Dr. —— engaged?

S. No sir; walk in; he will see you at once.

F. Ah! how do you do? I have brought my friend P., who is not very well, and wishes to consult you.

Dr. What is the matter?

P. I believe I am troubled with the Blue Devils.

Dr. It is odd you should make use of that term, as I am now engaged in studying the subject, and I believe that I have succeeded in demonstrating to my own satisfaction the exact position held by the Devil.

P. You must pardon my interrupting you, but I am entirely at a loss to understand you.

F. My friend, Doctor, is one of the old school, and has a great respect for the Devil, and does not comprehend your laying him upon the table for anatomical purposes.

P. I do not consider that this is a proper subject for a joke.

Dr. You must entirely misconstrue my observation if you think anything I said was meant as a joke. I was never more in earnest in my life. I firmly believe that I have at length succeeded in demonstrating the whereabouts of the Devil.

F. I am quite sure you are too thoughtful and too honest a man to joke on such a subject; and although I have the pleasure of reckoning you amongst my oldest and most valued friends, still you must allow me to say I do not at all know what you mean.

Dr. At that I am not surprised. But it would not take me long to make you understand my position, as you have followed me through all my physiological investigations, and are prepared to receive my latest discoveries.

F. Yes, but our friend here, although a well-informed man, knows nothing of physiological science.

P. You are right. I know nothing of modern science, and look upon it with horror. It is the great Iconoclast, uprooting and destroying all our beautiful images, that our old Faith has erected in her temples. I cannot bear to hear the word, or to meet a man of science. You will pardon me, Doctor, I am sure.

Dr. Most certainly; and I should not wish for a more congenial occupation than to prove that modern science is no iconoclast. On the contrary, that she, like some of our modern church architects and restorers, merely strips off the plaster and

paint that covered many a beautiful marble column and sculptured tomb, and exposes to the light beauties that have lain hid for centuries.

P. Sir, you would obtain my thanks could you do this; but I warn you before you commence you will fail. I have my faith, and I do not wish it unsettled.

F. I see; and to prevent it being unsettled you will neither read nor hear anything of the new views.

P. You are right. I have read none of the pestilent and heretical works lately issued, and I have no wish to. I believe in the old saw, "You cannot touch pitch without being defiled."

F. But are you a fair judge of what is and what is not pitch? Stay, we are interrupting the Doctor, whose time is valuable.

Dr. Not at all. I prefer demonstrating my views to an intelligent audience to listening to the ailments of a patient. Besides, my work is over for to-day; and if you have an hour to spare, I will run through my argument, and I am glad to have your friend here to stop me when I get obscure.

P. If I am to stop you when I do not understand, I fear that instead of an hour, we shall be all night.

F. Not at all; the Doctor is very clear. You must remember he has had me to practise upon, and, you know the old saying, it has made him perfect.

Dr. Then to begin. What I wish to explain to you is that the Devil is neither a person nor a spirit, but that there is an evil principle connected with the flesh. I would rescue him from the poet, and hand him over to the doctor. Now, let me ask you what you understand by the Devil?

P. You give me no time to collect my thoughts; therefore what I say now I may think fit to modify; but I should define the Devil as an evil spirit, antagonistic to the Deity, the enemy of mankind, ever engaged by means of his agents in undermining man's faith, inciting him to crime, and tempting him from the path of virtue.

Dr. Quite so—in fact Milton's Devil, the concentrated wisdom of the thinkers and poets of all time, men of genius, prophets in our age, leaders of men in all.

F. But Milton's is not the only Devil. You must not forget Luther's; for, according to his writings, no man has ever had so intimate a knowledge of the Devil as he had.

Dr. Permit me, however, to begin at the beginning. In studying the Biblical writers, we find that Moses makes the enemy of man a serpent; then in Leviticus he speaks of the devils as "the hairy ones," "goats;" in Deuteronomy, "Destroyers;" in Job, Satan (the adversary) is introduced as an individual, an angel, who is allowed by God to tempt and endeavour to overcome the virtue of Job. In the other books of the Old Testament the Devil signifies the adversary, or is worshipped as an idol, or false God. With the exception of Eve and the serpent, and in the book of Job, nowhere is the Devil described as an evil spirit, tempting man. At the coming of Christ the Jews believed that the devils were an innumerable army of evil spirits, surrounding, and ever ready to mislead man, with Satan as their leader; and the Evangelists in their writings decidedly individualised Satan, as in St. Matthew's description of the temptation in the wilderness: here Satan is described as a man, arguing and reasoning with Christ, as the Scribes and Pharisees did.

F. You say nothing of the opinions of the great philosophers.

Dr. I do not find in the works of Plato that Socrates believed in the Devil; he acknowledges the Deity, the immortality of the soul, the desirability of death to those who have led a virtuous life, and the relegation of the souls of the wicked to another existence until purified; but I cannot say I detect anything resembling the Devil as defined by P. Socrates recognised the weakness of the flesh, and mourned over sin; but the Devil was not known to him. The Dæmons of the Platonists bear no resemblance to Milton's Devil, as the following extracts from Apuleius will show: "These Dæmons are the bearers of blessings and prayers between the inhabitants

of earth and heaven, carrying prayers from the one and assistance from the other; by them also all revelations, all the various miracles of magicians, all kinds of omens are ruled. They have their several tasks to perform, their different departments to govern; some directing dreams, others the disposition of the entrails, others the flight of birds. . . . Each man has in life witnesses and guards of his deeds, visible to no one, but always present, witnessing not only every act, but every thought. When life has ended, and we must return whence we came, this same genius who had charge over us takes us away, and hurries us in his custody to judgment, and there assists us in pleading our cause. If anything is falsely asserted he corrects it; if true, he substantiates it; and according to his witness our sentence is determined." This is the poetical idea of the guardian angel, and rather a beneficent than a malevolent being. In fact, the Greek and Roman philosophers had not imagined a Devil: Pluto, although God of Hell, was by no means the Devil.

P. The opinion of the philosophers bears no weight with me. The Evangelists were quite clear on the subject; they speak of Satan as a bodily presence, as an embodiment of evil; not as the spirit of evil, but as walking the earth, and making his presence felt.

Dr. No doubt such was their view. If there is any value in language, so they expressed themselves; but you must remember that the Evangelists were not men of education: they were men of feeling, of heart, of faith; they had the poetical temperament, and would readily lend themselves to the incarnation of a legend. But let us pass over this, and come to the writings of St. Paul. Here was a man, one who knew and felt the flesh, and yet was spiritual above others. St. Paul was a compound of Mind, Soul and Flesh, and we have in his writings a correct definition of the Devil. In his Epistle to the Romans, the Apostle, speaking of sin as a person (the Devil), says: "For we know that the law is spiritual, but I am carnal, sold under sin (the Devil). For that which I do I

allow not: for what I would, that do I not; but what I hate, that do I. . . . Now then it is no more I that do it, but sin [the Devil] that dwelleth in me. For I know that in me (that is, in my flesh) dwelleth no good thing. . . . For the good that I would I do not: but the evil which I would not, that I do. Now if I do that I would not, it is no more I that do it, but sin [the Devil] that dwelleth in me. I find, then, a law that, when I would do good, evil is present with me. For I delight in the law of God after the inward man: but I see another law in my members, warring against the law of my mind, and bringing me into captivity to the law of sin [the Devil], which is in my members. . . . So then with the mind I myself serve the law of God; but with the flesh the law of sin." I shall pass over the views held by heathen nations of the Devil, and come to more modern times, when the ways of the Devil were studied, and demonology and witchcraft became a science. The great protestant, Martin Luther, thus speaks of the Devil: "He is the enemy of mankind, the cause and instigator of all evil, not only to man as a spirit, but acting through the elements, and producing storms, earthquakes, and epidemics. Thus the Devil had innumerable imps, who acted under his orders, residing in woods and waters, and dark pooly places, ready to hurt passers by. There are devils also in the thick black clouds, who cause hail and thunders, and lightnings, and poison the air and the fields and the pastures. The Devil sendeth all heavy diseases and sicknesses upon people; when our sins get the upper hand, and all is going wrong, the devil must be God's hangman to clear away obstructions and to blast the earth with famines and pestilences. Whatsoever procures death, that is the Devil's trade. All sadness and melancholy come of the Devil; also insanity. He is the opponent of divine grace in the hearts of individuals." Luther, therefore, went further than St. Paul in his belief in the power of the Devil; but then the former lived in an age when witchcraft was the ordinary belief of the people; when old women were burnt or drowned for having sold themselves to the Devil,

when it was believed that the Devil *in propriâ personâ* could be raised by a certain form of words. Proceeding to the views of Milton, than whom no one has had so great an influence in guiding modern opinion; following Job, Milton looked upon Satan as a fallen angel, who rather than "serve in Heaven would rule in Hell." This great being did his best to destroy and degrade the works of God; he therefore tempted our first parents to their fall, and has ever since interfered to prevent mankind becoming godlike. I merely mention Milton from his having so swayed modern opinion; so much so that the far sounder views of Paul are forgotten. Dante, Goethe, and numerous other writers of less note, have given us their views of the Devil; but as they have produced but slight effect upon popular opinion, I pass them by. The present is a period of vast scientific progress; science has been gathering fact upon fact, observation upon observation, until, like the avalanche, the accumulated mass has been too much for the usual supports, and, rushing down from the heights, has carried darkness and ignorance before it, and overwhelmed the people in its flood. If the chief study of man be man, surely the modern student has a vast tome open to him. The gigantic labours of the physiologist, histologist, chemist and electrician have so mapped our bodies to the prying eyes of science that there is no portion, however minute or delicate, that is not tabulated, valued, and weighed; and I shall now enter somewhat minutely into the process of life. One great question causing much bitterness and great discussion amongst theologians of the last century was, "How many legions of angels could rest upon the point of a needle?" Now, this idea of extreme minuteness must be grasped by the mind if we are to investigate the arcana of life, and therefore we must call the microscope to our aid. A man is built of innumerable entities, as a house is built of bricks; but each component brick is alive, having a separate, independent existence, and each brick is formed of countless molecules, and these again of innumerable atoms. An atom is hypothetical as to our senses; still they are demon-

strable to our reason. All gases are formed of atoms, and we know that the principal portion of the body is formed by the aggregation of the atoms of gases.

P. Excuse me, but I do not understand what you mean by the atoms of a gas. Gas is impalpable—I told you I was perfectly ignorant of science; and you desired me to stop you when obscure.

F. One moment before you reply: is it your wish that P. should enquire whenever he does not understand?

Dr. Most certainly—his remarks are of the greatest value to me. I look upon P. as representing the intelligent but non-scientific public, a type of the very class to which I wish to make myself clear. I have already written for the men of my profession; now I wish a wider sphere. But to answer your question. You say a gas is impalpable. True, to our senses; so is an odour impalpable to our sight, hearing, or touch; but if it were not made up of particles, which impinge upon the membrane which has the power of assaying these, and referring them to the brain, which determines the nature of the odour, it would not be perceived. Again, here is some water; you can drink it, or wash your hands in it, but, for all that, it is but a combination of two gases, oxygen and hydrogen, which must be composed of atoms; otherwise when combined they would not be palpable.

P. Yes, that I understand.

Dr. Now, these atoms are too minute for demonstration—they are hypothetical; but we know they exist. We also know that they are in motion; and, although they are so infinitesimally minute as that they never can by any chance be demonstrated separately, yet we can satisfactorily prove their existence as distinct atoms, as also combining with others, forming compound atoms.

P. This latter proposition is simple: if I allow that there are distinct atoms, I may easily do so to the compound.

Dr. I am sorry to say I have to call still further upon your credulity as regards these atoms, for we know that they

are formed of two distinct parts; that they are spheroids, having a dense axis, and a less dense equator. For instance, the axis of the atom of oxygen is formed of ozone, the equator of antozone; the atom of water has oxygen for its axis, and hydrogen for its equator.

P. This is altogether beyond me—but proceed.

Dr. You will see shortly what I wish to prove. Now, where we have atoms of different densities a current of force is at once generated from the more dense to the less dense—no atom but has associated with it force. This force has been called by various names—at present it is termed electricity; but electricity is a mere name, and there can be little doubt that all the forces, which have many names, are but one force modified by matter. An atom on receiving force expands at the axis, and on giving it off contracts at the equator; thus we have a current through the atom. Now, mark this—if the spheroid be free, as in a gas, these currents set up rotation, and vibration results. If it be not free, as in a solid, where it has entered into secondary arrangements with other spheroids, instead of the currents producing rotations, they are directed in a certain route, so that by the multiplication of numberless currents, all directed towards a certain point, an appreciable force or power is generated. These currents are not continuous, but intermittent, as the spheroids have to absorb as well as to give off the force; so that to produce a continuous stream, the intermittent currents must be collected, retained, and supplied as required. Now, please to take particular notice of this, because later on I shall have to remind you of it.

P. I understand partly what you mean.

Dr. I have now shown you of what a gas consists, and also that water is merely the combination of the gases oxygen and hydrogen. Now I will show you here under the microscope the formation of a solid out of the atoms of a gas. If you will glance through this microscope you will see an oblong cell; this is one of the joints of an algal. You will see that the contents are circulating round the cell. Now, if you will watch

carefully, you will see a minute molecule vibrating; this gradually increases in size, and when it has completed its growth, it ceases to vibrate and attaches itself to another, and so on. Now, these little masses are granules of starch, which you have seen formed under your eyes, and, chemists tell us, are composed of carbon obtained from carbonic acid gas, hydrogen and oxygen from the water, and salts found in the fluid of the cell. In the same manner all the complex substances found in the vegetable kingdom are formed; the materials are absorbed, they are broken down into their ultimate atoms, from which fresh combinations are produced. These disruptions and combinations take place through the agency of vital force, of which we shall speak more fully hereafter.

P. What you have shown me and explained is most beautiful, and I have now a glimmering of your meaning. The atoms of a gas, which are so far apart when forming the gas, become condensed and approach each other in combination.

Dr. Quite so; that is it precisely; and if you can remember that matter, even in the form of a gas, is combined with force, and that solids, however inert they may appear to be, yet have mixed up with their atoms, force, I may approach the more complicated questions of vital force and nerve force.

P. I guess at what you wish me to gather—namely, that all matter is combined with force, and that vital force is merely a modification of this.

Dr. You will see as I progress. But before I go any further I will give you some idea of force, and also, in this case, my authority, as otherwise it is so marvellous you might feel inclined to doubt me. Faraday, in his "Experimental Researches in Electricity," has given us a very clear notion of the *quantity* of electricity evolved during chemical action, which, in a state of *tension*, would be equal to a flash of lightning. "The chemical action of a grain of water upon four grains of zinc

can evolve electricity equal in quantity to that of a powerful thunderstorm."*

F. Marvellous indeed; you quite astound me. I had no idea of anything of the kind. In one drop of water there is sufficient force that, if it were all freed at the same instant, it would produce the same result as a flash of lightning!

Dr. I am now going to enter upon the physiology of man; to show you how he is formed, and how his circulating and nervous system is supplied by the force. The food is broken down in the stomach and is digested—that is, separated into the various ingredients necessary for the formation of the blood, and the remainder is cast off as an excretion, being useless for nutrition. When digested the food is reduced to a solution of a low type of proteine, fat finely divided, and salts; the soluble matters, such as gelatine, alcohol, sugar, &c., being absorbed directly by the circulation.

P. Do I understand by proteine—flesh?

Dr. Not exactly; flesh is composed of albumen, fibres, &c. Now, albumen and fibrine are proteine plus phosphorus and sulphur, and are all chemically but little different one from another, but they are vastly different as regards their vital properties. Albumen in a live animal has all the capacity for carrying out vital acts. For instance, muscular tissue is formed from albumen, but when the muscle is worn out by use, it is fibrine. Again, fibrine is the last act of life; albumen is live fibrine; fibrine is dead albumen. Proteine is a lower type of albumen, not so vitalised.

P. I believe I comprehend: the stomach has dissolved the flesh into proteine, which you are about to show is converted afterwards into albumen.

Dr. Precisely. Now I must say a few words on the secretions, as it is necessary for my future argument; but I shall not be very precise, because I wish to interest you, not to bore you. The secretions necessary to produce healthy digestion must themselves be healthy; they are the saliva, the pancrea-

* Series VII., Vol. I., Paragraph 873.

tic fluid, the gastric fluid, the bile, and secretions from various fluids in the course of the intestines. The saliva contains a peculiar ferment, which has the property of producing the first stage of converting starch into sugar. The gastric fluid contains a ferment, having the property of converting albumen, fibrine, &c., into proteine; the pancreatic fluid has much the same property as the saliva; the bile has the property of emulsifying the fats and stimulating the lacteals to its absorption; it arrests the fermentation which has been commenced in the stomach, and putrefaction in the intestines; it stimulates their peristaltic motion. If prevented from entering the intestines the animal rapidly wastes, and death ensues. But the liver has many other functions besides the secretion of bile. The blood that has supplied the stomach with ingredients for digestion, and which has taken up soluble matters, is forwarded by the portal vein to the liver. Now, this large organ has most important duties to perform; it is a complementary organ; *it has the power in health* of secreting the exact desideratum required by the wants of the body. The secretion of the liver, therefore, depends upon the food taken into the stomach, and it can convert these ingredients into the various requirements of the body. The liver secretes a large quantity of animal sugar, from gelatine, used in the lungs and circulation for the purpose of producing heat and nerve force.

P. The liver, then, appears to be a sort of corrective to errors of diet, and may, if healthy, even counteract faults committed by other organs.

Dr. Doubtless, for a time; but if one organ is unhealthy, it soon upsets the others. But now we must see what becomes of all this digested food. It is now in the form of a viscous fluid, termed chyme, and as it passes along the walls of the intestines, the lacteals (innumerable tubes lining these walls) absorb the nutrient fluid; and as it passes on under the name of chyle, is found to consist of phosphates of lime and magnesia in solution, proteine, and finely-divided fat; the phosphate salts, which had been retained in solution by a free acid, now, in

the alkaline chyle, immediately commence to crystalise. Now the crystalisation of phosphate of lime in proteine solutions is peculiar; instead of crystalizing in angular forms, the atom, during vibration, attaches to itself other atoms, until it becomes a molecule, visible under the microscope, vibrating the whole time. These molecules of phosphate of lime are coated with layers of albumen and oil, and are imbued with life, although in the lacteals not of a very high form.

P. You say these molecules are imbued with life; what do you mean by that?

Dr. You ask me a most difficult question to answer, because, although I perfectly understand what I mean myself, knowing all the arguments to come, I cannot expect you to do so. I must, therefore, beg of you to defer this question until a future period. From these molecules of proteine and oil, with a phosphate of lime skeleton, the chyle cell is formed. I shall not trouble you with my views as to the formation of the chyle cell; sufficient to say that it is the parent of the blood cell, and that it is formed by the aggregation of these minute phosphates of lime, albumen and oil molecules.

F. You have often told me, but I am sure P. would be glad to know, how you account for this vibratile motion in the atoms and molecules.

Dr. In the formation and disruption of all animal matter, vibration among the molecules is always demonstrable by the microscope. It is, therefore, not always certain, when vibration is observed, to what category it belongs; but in completion the molecules increase in size, and become attached one to another; in disruption the molecules decrease and gradually disappear. Water, or its component gases, is the means by which this vibratile action is produced: in completion, water, or one or both of its gases, is added to the increasing molecule; in disruption, water, or one or both of its gases, is separated from the molecule; the other atoms forming the molecule being broken away by the separation of the interstitial water. The attraction and repulsion produced by these sepa-

rations of atoms cause the peculiar vibration seen in the molecules of organic matter. And now we approach the blood, and I fear I shall be somewhat prolix, but I will do my best to be as terse as possible.

P. Before entering upon the blood, suppose I just explain to F. what I have gathered up to the present, namely, that the chyle is the parent of the blood, and that it contains innumerable particles of vitalised matter, either distinct in the fluid, or in conjunction forming the chyle cell.

Dr. Undoubtedly you have perfectly understood me. The blood that enters the right side of the heart is a most complicated fluid; it is composed of the fresh chyle, the venous blood from the muscular system bringing back the effete matter collected during circulation, and also the blood from the liver, spleen, and other glands—all this blood is now to pass through the lungs to be aerated, that is, to free itself from carbonic acid, and to receive oxygen in exchange. The changes effected during the passage of this mixed blood through the lungs is the most beautiful that can be imagined; and it depends upon this change whether the arterial blood which is to be supplied to nourish the body is healthy. If you remember, when speaking of the liver, I told you that that organ passed a large quantity of sugar on to the lungs; this sugar, upon meeting with oxygen, becomes converted into acetic and lactic acids, which, acting upon the carbonates, expel the carbonic acid in the cells of the lungs; at the same time, the acetic acid, by its stimulant nature upon the chyle cell, forms within it the free cellæform nucleus, or young blood cell. Now, should the liver not forward this sugar, or should the acetic acid not be formed within the lungs, instead of the young blood cell appearing, we have the chyle cell circulating in the blood (and there is actually such a disease); but this is only one of the marvellous changes effected during the passage of the blood from the right to the left heart. But now I wish you particularly to notice my next argument, because upon it hangs much of what I shall eventually endeavour

to prove. The pure arterial blood which is forwarded from the lungs to the left heart, to undergo no further change, but to supply the tissues and organs with nourishment, depends for its purity upon the changes effected in the capillaries of the lungs by æration on the various bloods forwarded from the principal organs, as the liver, stomach, pancreas, spleen, kidneys, &c. Now, should any of these organs be out of order, you will be able to understand that the blood in the right heart will not be in that normal condition which it should be.

P. Yes, I can see that; but surely there is some compensatory organ to counteract such an error.

Dr. Certainly: almost any organ will endeavour to do the work of another, and successfully for a time; but if the proper organ does not rapidly recover itself, the one attempting to do its work will get out of order, and then further complications ensue. But to proceed; we have now the pure blood pumped out of the left heart into the arteries, to supply the whole capillary system with nourishment for the various tissues, and with materials for secretion and excretion; and I must now show you under the microscope what takes place in these minute capillaries; and to do so I must call in to our aid this unfortunate martyr to science, the frog, whose foot must from all time have been prepared for microscopic examination, as it seems made on purpose for our use. You see I have one here ready placed upon the frog plate, and I put him under a half-inch object-glass to begin with. Just look through.

P. Oh, how beautiful! I see innumerable streams of a rusty-coloured fluid, rushing through minute vessels at a great speed.

Dr. Yes. But now I must point out to you several things that, unassisted, it would take time for you to discover for yourself; for as Carlyle has beautifully remarked, "The eye sees what it brings the power to see." We will therefore change the object-glass to a quarter, and focus. On one side of the web you will see the artery and nerve; they are of

about the same diameter, but the nerve is formed by the interlacement of numerous dark bordered tubules. You will observe that the artery terminates by dividing into many smaller vessels. They are the capillaries; they differ from the artery by having no walls proper. The coat of the artery, you may observe, is formed by layers of elongated flattened cells, whereas the capillaries are bored in the tissue itself. Now you must look very closely, and you will see that the tissue between the capillaries is formed by the aggregation of corpuscles.

P. Yes: they are pressed against each other, and are of different shapes accordingly; but I see that they are flattened when they become the walls of the capillaries.

Dr. Yes: the blood-cells and corpuscles, as they pass along the walls, flatten the corpuscles of the tissue, and smooth them. Now, if you will allow me, I will find a portion of tissue which I wish to describe. Here is a capillary dividing into two; at the fork you will see a few pigment corpuscles. Now, where a capillary divides like this is a most favourable position, because, as the cells and corpuscles arrive at this division, they appear to hesitate—they crowd one against another. You must take what I tell you now for granted, as it would require you to watch for perhaps an hour before you might see it. The capillary expands or contracts, or rather the tissue corpuscles expand or contract, to the stimulus of heat, cold, or nerve force.

P. I see that the capillaries are of different calibres—some are much wider than others; but I notice that the large oval cells travel much quicker than the round white ones. Also they have a different method of advancing, the oval ones seem to have a sort of intelligence—if I might employ such a term—whereas the white are pushed about by the others, and drag along.

Dr. You are quite right. There are two forms of corpuscle in the blood of the frog—the coloured and the white: the coloured in the circulation is an oval, flattened, perfectly

transparent cell, extremely elastic, and able to take any form required by the tube through which it is passing, and the obstructions in it. The white is globular, granular, elastic, but always retaining its shape; of different diameters, some being twice as large as others. They always drag along the walls of the vessel through which they are passing, the coloured cells wriggling past them; occasionally several white corpuscles congregate together, obstructing the circulation. The coloured cells, however, insert themselves between them, taking any form so as to pass on. The tendency of the coloured cell is to proceed as rapidly as possible; that of the white, to drag and congregate together, obstructing the capillary circulation. There are about twenty-five coloured to one white corpuscle. Now, if you will allow me, I will try and find another portion of tissue which I will explain to you. There ——

P. What I perceive is a larger space of tissue than usual, without a capillary passing through it.

Dr. Yes; but what I am going to tell you I cannot demonstrate, because it would take many hours to do so. The space of tissue you see has a capillary passing through it, but being choked with colourless corpuscles, which are of exactly the same nature as the tissue corpuscles, you cannot detect the difference; but if you were to watch this space for an hour or two, you would observe vibration commencing amongst these corpuscles; the force of the circulation in the adjoining vessels is communicated to the one under observation, and the white corpuscles are slowly pressed onwards, and are driven into the circulation before the advancing coloured cells. But the new capillary is not exactly in the same position as that previously held by it—but has been bored through an old portion of tissue. Upon the return of the circulation in the capillary, the beating of the cells gradually flattens the corpuscles, and they form part of the smooth wall of the capillary.

P. Then you mean that the tissues are actually formed from the corpuscles.

Dr. Yes. And now I am going to tell you something else which you will not find in the books. Still, I am confident of what I am going to state, having observed it too often to be mistaken. In the circulation, the coloured blood-cell contains *no nucleus;* out of the circulation, or after death, or during such changes as I have described, a nucleus forms within the cell. You will perceive, therefore, that in the repair of the tissue forming the web of the frog's foot, the coloured cell is placed bodily in position; it then gradually collects within itself its plastic contents; the coloured matter is poured out, and it becomes a single brick of the repaired tissue. But in other tissues, nerves, muscles, &c., it is quite evident that this method of repair cannot be the one employed. Here is a mouse, unlike the frog, which I will now set free—see, he hops away none the worse—to which I give chloroform; he is now asleep, and what I do I must do quickly, as the mouse lives but a short time; see, I draw out the mesentery and place it under a quarter object-glass, with the chloroform under the mouse's nose, which will keep him asleep until he dies. Now let us see, the mesentery is composed of a net-work of fibrous tissue, with transparent interspaces; an artery, dividing into larger and smaller branches, runs towards the bowels; at the bifurcation an eddy is seen (during the rest between each impulse of the left ventricle) to contain cells floating in serum. The repair of tissue is as follows:—a capillary becomes blocked with cells, the pale corpuscles break down, their contents becoming minute fibrillæ; the coloured cells melt down in the interspaces, forming the interfibrous membrane, which, in the live animal, as you see, is perfectly homogeneous and transparent; but after death, or upon dropping acetic acid upon it, which I will now do, it takes a cellular and nuclear arrangement. I can show you thus far, but now I must tell you what I deduce from my studies: I cannot demonstrate what follows.

P. The circulation has ceased under the microscope.

Dr. The reason is obvious; our poor little subject is dead.

I seldom experiment on warm blooded animals, as they always die under examination. The capillaries, running as they do in the areolar tissue (as it is correctly called in man, although cellular in reptiles and cold-blooded animals), afford nourishment to the other tissues; that is to say, the areolar tissue acts as a sponge, absorbing the materials from the blood, which is constantly pouring in its substance to supply the more delicate tissues with materials for their repair; blood-cells actually melting down into a solution of molecules for such purposes. The areolar tissue is found everywhere where blood vessels are required, except in some of the glands; the capillaries there running between the cells themselves. During life, areolar tissue is transparent and apparently homogeneous, but after death, or by the aid of reagents, nuclei and cells are produced, showing the original materials of which it is composed.

P. If I have understood you correctly, all the tissues, even the most complex, as the nerves, are formed by the melting down of the blood-cells, giving up elaborated materials for their formation.

Dr. Yes; the blood cells, by which the plastic matter is prepared, pass through many phases and visit many organs, imparting and receiving fluids, by which the changes required for their ultimate consummation and ability to form a part of the solids of the body are effected. Whilst undergoing this process secretion takes place: the glands—aggregations of cells—remove crude ingredients from the new blood, and produce a change in them, adapting them to the wants of perfectly normal blood. Excretion is the act of removing from the blood old and waste matter, principally derived from the worn-out tissues, which have been removed, and replaced by new blood-cells.

And now we come to the nervous system, and if you have understood what I have already explained to you, you will have no difficulty in understanding the circulation of nerve force.

The lower types of the animal kingdom, although endowed

with sensation and motion, have no nervous system; and yet they have intelligent movements, which can only be accounted for by the presence of sensitive corpuscles, the tissues themselves conducting the force from one nerve corpuscle to another. In the fœtus of the higher animals, before the formation of a connected nervous system, the peripheral nerves are formed from stellate cells, which lengthen and join together, forming a continuous nerve tubule. But there is a time when they are perfectly independent of the great centres, and yet all the various and complicated processes of increase and nutrition proceed perfectly without the aid of any nervous centres beyond the corpuscle in the immediate neighbourhood. To account for this, an inherent and distinct vitality in the part itself must be conceded. This is proved in the cold-blooded animals. The turtle, a cold-blooded animal of very complicated structure, may have its heart removed and cut into a hundred pieces, yet each portion will keep up a rythmic contraction and dilatation, as if it were a constituent of the living body of the animal, proving that its vitality is inherent within itself, and although intimately connected with the rest of the animal by nerves, still is independent. In warm-blooded animals, the connection between the great centres and the peripheral system of corpuscles is most intimate, and any peripheral injury, however slight, is at once appreciated by all the nervous centres; and it is this delicate connection of the nervous system that places man at the head of created beings, and yet makes us so much more liable to suffer from external influences. Passing by the side of every artery, down to the most minute, only to be demonstrated by the microscope, is a bundle of nerve fibres; these decrease in number by degrees, until we find two tubules running side by side along a capillary; these terminate in a sensitive corpuscle. Upon the branches of all arteries supplying any portion of tissue, small masses of nerve corpuscles may be demonstrated by the microscope; these are termed ganglia. As the nerves pass on towards the centres, these ganglia become larger and receive a larger number of

nerve tubules, which mingle together, forming plexuses, by which means intelligence is received from every surface tissue, and after being considered by the ganglia, is acted upon by return nerves to the part itself, or is forwarded on for further information to the spinal cord, the cerebellum, or to the brain proper. The proper way to study the nervous system is to first consider the sympathetic ganglionic or organic system, for this system is bound up with the tissues themselves; without it, no growth, nutrition, or secretion could take place, whereas the spinal system and brain, although of course necessary to the perfect animal, are not necessary to the carrying on of the organic functions for a time. For instance, in the fœtus the brain is not called into action until birth, and the spinal system not for four or five months after conception, the previous growth being entirely supervised by the sympathetic system and sensitive corpuscles. To every portion of tissue, however microscopically minute it may be, one of these nerves arise; it travels along the minute artery until it terminates in a ganglion corpuscle, an enlargement of nervous matter; this corpuscle gives off another tubule, which travels along the vessel, and is distributed to another portion of tissue. Now here we have a complete nervous system—a portion of tissue, with its capillaries, supplying the force; a ganglion corpuscle or brain to supervise nutrition; and a reflected nerve tubule to other tissue to complete the circuit. To explain this I must describe to you a galvanic couple, consisting of two metals, an acidulated fluid, and a conducting wire; one metal must be more oxidisable than the other—that is to say, the acid fluid must attack the one rather than the other. Now let us take zinc and silver, and place them in a little vinegar and water; the acid at once attacks the zinc, the oxygen of the water combines with the zinc and acetic acid, to form acetate of zinc, and the hydrogen flies to the silver. But this is not all the force: electricity, if you like to call it so, which had held the oxygen and hydrogen in combination, is freed and circulated through the wire, joining the metal plates out of the fluid; and as long as this

wire and any free acid remains, this action continues. This is a galvanic couple, and the silver plate is negative by induction; that is to say, although the zinc is the positive and only metal acted upon, yet the silver negative metal is necessary to receive the hydrogen gas upon its surface, and conduct the negative electricity. Two metals are therefore actually necessary, one in an active, the other in a passive condition. Now let us apply this to the sympathetic nerve system. The portion of tissue undergoing repair is in the same condition as the positive metal; oxidation is going on, and the positive electricity is carried along the nerve to the ganglion corpuscle; but the other nerve, from the other portion of the tissue, is by induction in a negative condition. But at another time this condition is reversed; the negative portion of tissue is positive, and *vice versâ*. The function of a ganglion corpuscle is to control this action; it has the power of arresting this action, or reversing it. It is also in conjunction with other ganglia that have like functions, and they together supervise the healthy nutrition of a part; they also store up the electricity, or vital force, which they have received during tissue change, retain what they require for their own well-being, and pass on the excess to the next ganglion. Now I have before attempted to show that although we have only one term for this fluid, namely, electricity, yet that it is not electricity as we find it when in conjunction with inorganic salts, metals, &c., but by the reaction of the materials with which it is now in combustion it is vitalized, that is to say, modified by the new combination of matter. Now each tissue and organ generates a different form of vitalized electricity, which may be combined under the generic name of nerve force or nervicity, and this nervicity differs according to the tissue or organ giving it off, and the action of the ganglia upon it. Now as the ganglia approach the more central nervous system, namely, the spinal cord and brain, they have modified the nervicity brought to them, and have as much as possible brought the nervicity to the uniform standard of health of the animal, so that the cord

and brain receive healthily generated nervicity to carry on their functions. The function of the spinal cord is to receive ordinary sensation from the skin (with the exception of the palms of the hands and soles of the feet, which are in immediate connection with the brain, being the sense of touch), and to transmit it to the brain, and to act upon the voluntary muscular system when ordered by the brain. The spinal cord receives its nervous fluid from the sympathetic ganglia. The function of the brain is to supervise the senses, to receive sensation from the surface, to control and instigate muscular action; and then the higher function, as the storing of ideas and sensations (memory), the combination of these (imagination), the combination of experience and education (reason). Now you can understand that, as the brain receives its nerve force from that collected and prepared by the sympathetic system, it depends upon the nervicity supplied by the ganglia how the brain may be affected in its judgment, and practically we know that the brain is biased by the condition of the secretions. Everyone in his own experience knows how differently the brain acts from day to day, even from hour to hour —dependent upon meals, the state of the weather, and every sort of cause modifying the circulation and secretions. And now, having travelled so far with me through this obscure question, I think you begin to see light enough to guide you to the goal I wish to attain.

P. I do begin to see what you mean, and I cannot deny the ingenuity of your argument, and its probable correctness; but it makes no difference in my faith that there is actually a malevolent spirit, inimical to man, whose business it is to destroy if possible the living soul within him, acting, I will grant you, through his passions, which you have, as you say, anatomised to me.

Dr. I am not satisfied with this. I protest that there is no evil spirit, external to man, at all; that the evil spirit exists within him, and is a concomitant of his flesh, and lives and dies with that flesh, whereas the soul (the good spirit) does

not die with the flesh; that never having been a part of the flesh, it cannot and does not die with it, but is immortal, and leaves the body upon death taking place, or even in some instances before.

Dr. And now let us sum up.

P. Pardon me for interrupting, but will you allow me to state my opinion of your views?

Dr. Certainly; I should be much obliged to you.

P. First, then, let me thank you for a most interesting physiological statement, which is perfectly new to me; but then I know nothing of physiology.

F. You may take my word for it that the Professor's views are chiefly, if not wholly, original.

P. I suspected as much, and I have the more pleasure in acknowledging my thanks, as I am about to criticise the deductions you draw somewhat strongly. Because you are clear in your own mind as to the various secretions giving up force to supply the brain and nervous system with their nutrition, you believe, and could teach, that the God-like spirit of man is deteriorated by a vitiated blood supply; and that the tempting of the soul by an evil being—the Devil—is to be laid to the influence of indigestion, or an over-secretion of bile! Why, what do you bring us to? Our evil passions are the result of a surfeit, the catching of a cold, bad drainage, want of ventilation, the food we eat, an epidemic influence. Why, you would take away from us all responsibility; we should be no longer free agents. What is the use of our religion? Why, according to your doctrine, under certain circumstances a blue pill and black draught would do more good than the most eloquent sermon or most earnest prayer. I think that should your views be accepted—which God forbid—the necessity for the teaching of religion would be done away with, and that instead of priests we should require doctors.

Dr. Much of what you have said is doubtless true; but still you have misunderstood me, as I feared you would, and therefore I am glad to have this opportunity of summing up, so that

I may attempt to disabuse your mind of the entire materialism you would credit me with. Now, I am about to recapitulate; the moment you object to any statement, do not hesitate to stop me.

All matter is combined with force, and according to the materials combined so is the resulting force. Thus, every combination of materials has its reaction of force—every form of living entity has its reaction of force peculiar to it; and when alive having all its individual forces acting in concert and for the benefit of the individual, whereas after death, although there is the same amount of force combined with the materials, yet the forces do not act in concert, but separately. Now, this dead individual, being formed of living matter, is capable of feeding other individuals; and we see that vegetables and animals, although dead as individuals, are able to render up their forces to nourish other vitalised bodies. Now in man the diet is very complicated; there is hardly any material that has once formed a portion of a living structure that will not afford nourishment to man—that is to say, when broken down by the digestive secretions, will not yield up force to form the new nutrient fluids. Am I clear so far?

F. and *P.* Perfectly.

Dr. Man is built up of the materials he obtains from his food; therefore his forces, although modified by his own particular essence, as I have explained, are still derived from the forces combined with the matter he lives upon. Now, the soul of man is a something which I, as a physiologist, decline to introduce into my argument, as it is something beyond mere vitality—it is a gift which God has granted only to man, and is not force, and has nothing whatever to do with life. Life is an attribute common to vegetables and animals, and is only in a higher and more perfect form in man; but the soul is something beyond all this, pure and God-like, and although inhabiting this corruptible body for a time, and linked with the low thoughts and desires inherent to the flesh, still is always enabled to emancipate itself from its thral-

dom, and eventually, upon the death of the body, escaping altogether.

P. Thank you, sir. A noble thought!

Dr. The soul is the spirit; it is the portion of God which He has given to every man—to one more than another perhaps, but still to all. This spirit is extra, supra-vital, and escapes upon death, being not of the nature of force, nor combined with matter. Therefore, the God-like portion of man is a grant to man, and returns to the donor after death. But now, let me turn to the evil portion of man—in other words, the Devil. This is inherent to flesh, to matter. As Luther says, "the Devil is found in marshy places, in convulsions of nature, in epidemics," and Luther was right. Wherever there is any evil principle, anything which works injury, the Devil, or evil, is there present, as much as in man. Do you suppose that the Devil is found only in man? I tell you that he is inherent to every animal or vegetable form of matter; that where there is force acting upon matter, there is the Devil. But let us return to man, and individualise some of the most potent actions of the Devil, or temptations, as they are called. The most common temptation to man, and which has existed from all time, is robbery. What is this? The taking the property of another for our own use. Now, I have not time to enter upon this subject with that minutiæ which is necessary to prove to you that robbery is merely the result of hunger; but will you grant me that?

P. I think I may grant you that. You mean that if you winnow the various causes conducive to robbery the chief would be to supply food?

Dr. Undoubtedly. Now, I suppose you will allow that hunger is inherent to flesh; therefore, this first and most common temptation to evil is merely the inherent cry of the body for food.

P. Although I have granted that the chief cause of robbery is the desire for food, I cannot allow that it is the only cause; a person may steal an ornament for the

sake of adornment of the person, or another for the sake of hoarding.

Dr. Quite so. But these I shall consider under the heads of vanity and avarice, and not robbery ; as the master passions are the former, and the latter is employed merely to gratify them. The chief temptations naturally arise out of the senses —sensual gratifications. I think you will grant to me that gluttony is merely the exaggeration of a natural desire for food, and although leading probably to many sins by upsetting the stomach and digestion, yet primarily is venial.

P. I cannot allow these statements to pass unchallenged. The sin of gluttony is merely a natural want exaggerated ; and if there is any sin attached to it, it is produced secondarily by indigestion really.

F. What do you say to this? I perfectly understand the Professor's reasoning, as do I also your objection, which I think quite right ; and I believe the majority of people, on hearing what we have, would agree with you.

Dr. Do not fancy that I wish to deny that, if one person in a thousand could follow me, I should be more than satisfied. We are taught that we have five senses ; why so I cannot say, for there are many more than that. But I wish to speak of one of those not spoken of in the books, because it is easy of demonstration and most striking—the sexual sense in man ; and this sense is as marked, having its centre in the brain and its peripheral apparatus, as is that of sight, hearing, taste, smelling, or feeling, and no one who thinks of the matter five minutes would deny it.

P. Excuse me one moment. You wished me to represent public opinion ; allow me to suggest that the public will not permit you to discuss the sexual sense.

Dr. I have not forgotten that, and although I wish to address myself to the public, still it is a select one. I can only expect to interest the teachers, not the taught. I believe that my whole argument will be caviare to the multitude.

F. I think, P., that the Professor may make his statement to us. Every author has his public—some very select, like Browning, Carlyle, or Mill; some appealing to everyone, like Dickens or De Foe; and yet the teaching of the former, by influencing the opinions of the latter, eventually becomes acknowledged by the world at large.

P. Of course I am aware that the "flesh is weak;" we are told so, but we are also taught that the Devil takes advantage of the weakness of man, and that the ideas are suggested by him, so as to ruin his soul.

Dr. It is this very notion I wish to combat. Ideas are not originated in the brain; they are derived from the senses. The brain has no faculty of origination; every thought, every idea, has been implanted in the brain by means of the senses. Take the writings of the most imaginative of mankind—Dante, Shakespeare, Milton, Swift, Poe—is there one single image that is not built up from our finite senses? What poet or painter who has attempted to depict the Deity has succeeded in the smallest degree? Does not every man acknowledge at once that God, infinite space, eternity, &c., cannot be defined—that it is beyond man's comprehension to compass these things; and should we attempt to think of these mysteries, we might say with Shakespeare, "This way madness lies."

P. Then what faculties do you give to the brain? What is a poet?

Dr. You know what mathematicians call permutations and combinations—that having a certain number of figures, they can be arranged in almost numberless changes. So the brain, deriving a certain number of ideas from the senses, according to the capacity of that organ, can combine them together in innumerable forms. You ask what is a poet? He is an individual having a peculiar constitution of brain, having the power of arranging such ideas as he has attained by observation and study in a new and pleasing form. You cannot mention to me any poet who has ever conceived anything, simply for this reason, that were such a thing possible it would be incom-

prehensible to others. Now, suppose it were desired to imagine a new animal, I ask you, P., to do so.

P. Well—his head should be large, with eyes situated on the top, his mouth at the side, and his ears on the opposite side, and without a nose; his body should be long, like a snake, ending in a tail, to which two wings are fixed, and without legs.

Dr. As I expected. It is a composite creature, impossible, but made out of others. Now I will describe you an entirely new animal. He is betrarchiar, with mofussulorus, the colour is pelango; he moves by zelvarus, situated on the minarchial flexangs; he ——

P. Stop! stop! I do not understand a word of your new animal.

Dr. No, I did not expect you would; but, therefore, you acknowledge that it is an entirely new creature, at the same time neither you nor anybody else could realise it.

P. But what do you say, then, to new inventions—steam, the electric telegraph, chloroform—are not these new?

Dr. New! what is there new about them? They have existed in embryo since the creation of the world. I wonder you can ask me if they are new.

P. Can nothing, then, be new—can you imagine nothing new?

Dr. Can you?

P. The second coming of our Lord—the Day of Judgment.

Dr. Well, this has been described—you know how. The sounding of a trumpet, the rising from their graves of the bodies of numberless people, some dressed, others naked; up above a series of thrones, with angels seated; a dark abyss, with others being cast down into flames. This is paltry.

P. But how far from the reality.

Dr. If you think so, sit down and describe it better. You may use better language, but your ideas would be the same. But I must return to my line of reasoning. I have endeavoured to show you that the Devil—spirit of evil—is merely the forces

combined with the flesh, exciting desires in the brain; that some of these desires, if gratified at the expense of others, or even given way to to excess, are inimical to the individual, and therefore evil. But there is hardly a lust or sensual desire gratified that does not leave a stain behind, injurious to the individual or his progeny; for how remarkably has that law been carried out, laid down in the Commandment—"For I, the Lord thy God, am a jealous God, and visit the sins of the fathers on the children unto the third and fourth generation of them that hate me, and show mercy unto thousands of them that love me and keep my commandments." If my subject allowed me—but it does not—I should here show you what I believe hell to be. But I have said enough, at any rate for the present.

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